Sustainability: Making Your Computer Green

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Abstract: Although a computer has become a must have tool for most college students, many college students do not know a simple configuration that could help them to save some money on their utility bills and protect the environment. The purpose of this study was to develop and evaluate an instructional video module as a method of delivering information to college students at the University of Hawaii at Manoa's College of Education (COE) who use a computer on a regular basis. The video is divided into three parts and embedded in a web page. Twelve students participated in the study. This instructional video module focuses on participants' cognitive and affective domains in terms of sustainability in computer usage. Project testing showed that the use of video was an effective media to deliver the content to college students. Participants showed significant improvement from the pre-test to post-test after viewing the module. The pre- and post-surveys also indicated that participants are willing to purchase green computers in the future. Overall, this module successfully raised participants' awareness and affected their choice to be sustainable in the future.

Introduction

Chestney from Reuters.com published an article named: "People won't change lifestyle for planet" (2009). The article's straw poll shows that people are "willing to make small changes for the environment, …, but few would commit to more fundamental changes to behavior" (Chestney, 2009, para. 3). Awareness and behavior are the keys to encourage and motivate people to practice sustainability. This instructional video module is designed to raise participants' awareness and affect their attitude toward sustainability in terms of computer usage. Participants will learn and understand that being sustainable does not require a major change in their life styles and they can start from small changes without adversely affecting their lifestyle.

Nowadays' college students rely on using computers more than at any time in the past. As computer prices have become more affordable, more students own a laptop. In some colleges, computers have become a mandatory tool. While students are eagerly using computers in their college lives, most students are unaware of the environmental impact of a computer. Most consumers will purchase a computer based on the technical specification, but rarely based on the environmental impact of the product. Although there are manufacturers filling the niche of the "green" computer market, many people are unaware of the green computer's availability on the market.

The purpose of this instructional design module was to teach participants, college students, to understand the basic concept of sustainability and how to conserve energy when using computers

at home or work. Through this project, a video module was used to change participants' attitude, raise their awareness and modify their behavior to become more proactive in creating a green environment at their home and workplace. This instructional video module was designed to influence computer users' attitude and behavior to practice energy conservation through proper computer settings.

Literature Review

Sustainability is "the use of goods and services that respond to basic needs and bring better quality of life while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations" (Karsten & Reisch, 2008, p 49). The terms "being green" and "sustainability" are used interchangeably (Gross, 2007). Gross further defined that "sustainability is a commitment to economic and social development that does not cause damage to the environment and natural resources" (p 464). Computer users are often unaware of how much energy a computer consumes. By modifying the way they use the computer and by reconfiguring their computer settings, computer users could conserve a considerable amount of energy to make their computers green.

To change computer users' behavior, policy is often one of the most effective solutions, but requires support from the society (Karsten and Reisch, 2008). Raising awareness and social concern will help our society face the possibility of rapid climate change (Karsten and Reisch). Excessive use of energy is one of the factors contributing to global warming and climate change. Karsten and Reisch also indicate that sustainable consumption policy should encourage consumers to purchase products and services that are energy efficient in both production and use (such as minimally polluting, disposable, and recyclable). The value of sustainability also sits in the area where economic, environmental, and social concerns overlap (Herremans & Reid, 2002).

To raise consumers' awareness, materials were created to distribute knowledge about phantom power, screen savers, and environmentally friendly computers. These minor changes, which require a minimal lifestyle change, are a start to eventually influencing the society. Videos play an important part in this multimedia instructional module.

The use of multimedia has become an applicable resource in many curriculum settings (Yang, Huang, Tsai, Chung, & Wu, 2009). Traditional text-based learning has limitations because the human brain can learn better when watching imagery presentations as compared to just listening to a verbal presentation (Clark & Paivio, 1991). Studies also showed that "The advance organizer based instructional design approach guided the project team in making instructional design decisions regarding the workability of suggested design strategies and the accuracy, structure, and clarity of contents" (Hung, Smith, Harris, & Lockard, p. 76).

The use of subtitles in the video presentations is an assistive technology that learners could benefit from. Nugent (1983) suggests that only learners with adequate English proficiency can benefit from subtitled instruction. Subtitled video also provides learners an option to choose whichever fits their learning style the best (Lorenzetti, 2004). Subtitles also allow learners to capture the on-screen text and memorize the content. Cambra, Silvestre, and Leal's (2009) study

shows that the group of students who watched subtitled videos responded with much lengthier answers in the post-test questions because this group of students tried to memorize the video content word-for-word from the subtitles.

In order to maximize the benefit of subtitles, proper design needs to be incorporated. Jensema (1998) reports that 141 Word-Per-Minute (WMP) is the current standard TV programs use, and his study also shows most viewers are comfortable with 141 to 145 WPM when watching television.

Methodology

Purpose of the Instructional Design Project

The objectives of this instructional design project were to provide college students with instruction on learning how Phantom Power works and how to deal with it, configuring their computers to conserve more energy, and what are the hazardous materials used in a non-environmentally friendly computer. Video was used to deliver the content. The design incorporated subtitles to enhance understanding of the content, in particular for people who have hearing challenges or non-native English speakers.

Module Development and Design:

The ADDIE (analysis, design, development, implementation and evaluation) instructional design model was used for the design framework in this project. Analysis included the hierarchy chart to determine what participants already knew and needed to know for the module. In the design process, the researcher created a draft module or the so-called blue print for the development. In the implementation phase, the procedures for teaching the participants were created. It covered the learning objectives, outcomes and method of delivery. Evaluation included formative evaluation, which included a test run to receive feedback from the advisor and a subject matter expert.

The module was an eight minute video consisting of static images, edited footage, screen captured tutorial, and reading text. Demographic survey, pre-survey, pre-test, post-test, and post-surveys were delivered in paper format. Data was collected and analyzed in electronic format. Participants were given an instruction sheet to guide them through the study.

The first video contained information regarding Phantom Power (or Vampire Power) and how to deal with it by using a surge protector. The second video of the module contained instructions on how to configure a computer in a way that would consume less energy by using Jing for screen capture. The third video included information describing the difference between green computers and non-green computers and where to find certified energy efficient computers.

Various software and hardware tools were used in designing this project. The following were used: a video camera, lighting equipment, a printer, and an Internet connection. In addition, the following software was used: Jing, Final Cut Pro, Word Processing, DreamWeaver, Any DVD

Converter, Quick Time Pro, PowerPoint and Excel. Participants used a laptop with headset to participate in this study.

Although the videos were in digital format, the consent forms, surveys, tests and open-ended questions were delivered in paper based format. To minimize confusion, the researcher used a different color of paper for each form, survey, and test. The instruction sheet guided participants in each step with the corresponding color of paper so that participants would not be confused by the different forms, surveys, and tests. Each packet was labeled with an individual identification number. This way the researcher could collect and compare the data accurately.

One-on-One Evaluation

The module was evaluated by a subject matter expert (SME) and researcher's advisor before testing on participants. Both the advisor and the SME had their own computer and headset. Surveys and tests were printed out in paper and given to both advisor and SME for feedback.

The researcher interviewed the advisor and SME after they completed the module and questionnaire. The interviews collected qualitative data on module design to obtain specific details on areas of difficulty and clearness of objectives to improve the module before the final study.

Instruments

This module was intended to teach college students (undergraduate and graduate) who use computers frequently in their daily life either for school work or personal needs. Since the Internet has been introduced, college students have become more and more dependent upon using computers to communicate with their instructors, peers and family.

The module collected both qualitative and quantitative data for evaluation. The data collected, including a pre-survey and a post-survey, assessed if the participants had changed their attitude toward being sustainable. The pre-survey contained five likert-type questions to access participants' attitude before the module. This survey was designed to take less than two minutes to complete. The post-survey contained fourteen likert-type questions and six open ended questions to measure participants' attitude after the module and evaluate the overall design of the module. This survey was designed to take less than fifteen minutes to complete. The pre-test and post-test were used to assess whether the module's content was designed clearly and if the level of difficulty was appropriate. There were nine True/False questions and four multiple choice questions in pre- and post-tests respectively. Each test was designed to be completed within ten to fifteen minutes.

Findings and Results

The module's testing results showed that the use of an instructional video module to improve the participants' knowledge about being sustainable and becoming familiar with green products was an effective method.

Participants in this study were all in college or higher education. The demographic survey showed that 70% of the participants received a bachelor's degree, 10% had a master's degree, 10% had a Ph.D degree and 10% had a high school diploma (Figure 1). Half of the participants were females and the other half were males. 40% of the participants were already in the habit of using screen savers and only 20% shut down their computers when not in use. Interestingly, all of the participants claimed that they already were recycling which indicated this group of participants had already recognized the value of being environmentally sensitive or sustainable.

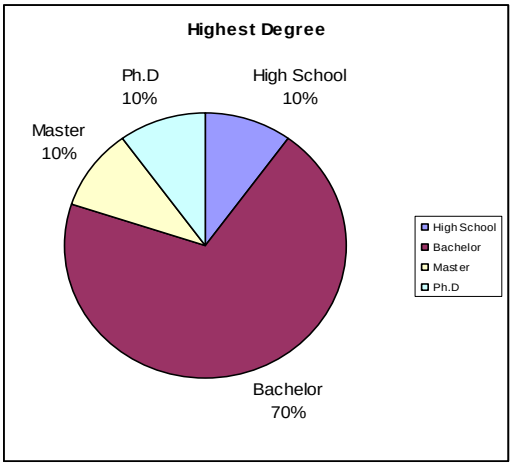

Figure 1. Participants' highest educational degree.

The pre- and post-test results showed that most participants improved their score after viewing the video module. In the pre-test, there were two participants who scored below 50% correct, four participants were in the 61-70% range, two participants were in the 81-90% range and only two participants scored above 90%. After viewing the video module, the post-test results showed a significant improvement. Seven participants scored above 90%, two scored in 81-90% range, and one scored in 71-80% range. None of the participants scored below 70% (Figure 2). This result indicated that the participants were able to learn the content from the video and applied it to the test.

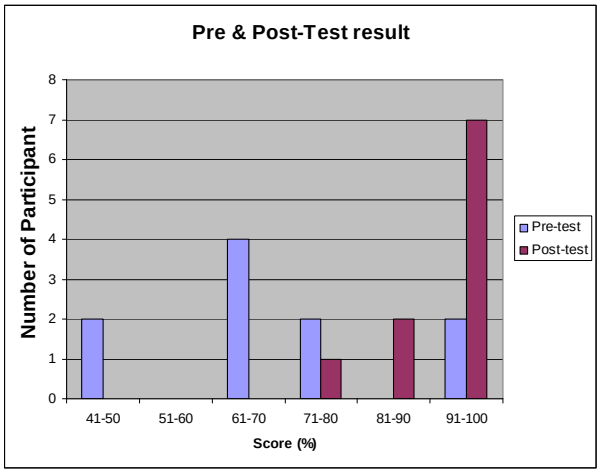

Figure 2. Pre- and post-test results for overall score.

In the post-test, four participants answered Question 2 incorrectly and five participants answered Question 7 incorrectly. Both questions were testing the participants' ability to identify under which working conditions users should choose to activate "sleep mode". The results suggested that the video needed to address "sleep mode" more clearly in detail since nearly half of the participants were still unclear about this information. Adding "sleep mode" in the recap might be one of the possible solutions to address this issue. In summary, the average pre- and post-test scores were 70% and 90% respectively. The test results showed that the video was effective in meeting its terminal objectives although there were some areas that needed to be improved.

The pre-survey revealed that 60% of the participants had never thought about buying a green computer and only 40% of the participants had thought about purchasing a green computer. After reviewing the module, 100% of the participants strongly agreed to consider purchasing a green computer for their next computer (Figure 3). The result showed that the video module was an effective way to change participants' attitudes toward sustainability. Another question also asked participants if being sustainable would require too much change of their life styles. In the pre-survey, 90% of the participants did not think so. The data showed that there was only one participant who agreed that it would require too much change of his/her life style. In the post-survey, that participant changed his or her attitude and agreed that it would not require a radical change of his or her life style to be sustainable.

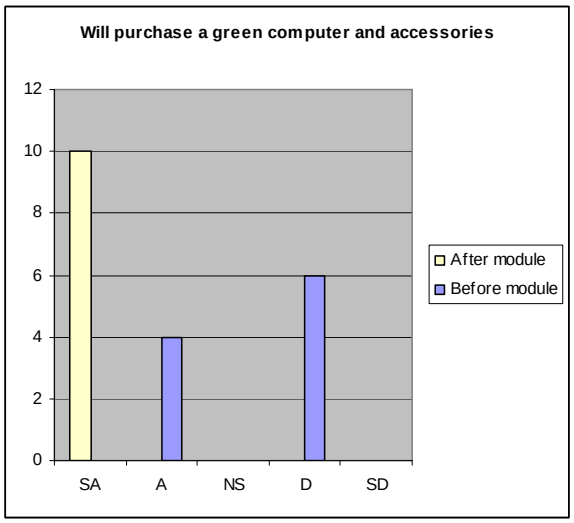

Figure 3. Attitudinal survey result for purchasing a green computer.

One open ended question asked participants which part of the lesson they liked the most. The responses were mixed. Each participant enjoyed the different design elements of the module. There were two participants who found the subtitles helpful in comprehending the content. The researcher interpreted that the design elements used in this project either incorporated a wide range of users' preferences or no individual design element stood out strong enough. A further study might be needed to focus on the design elements for this project.

In terms of which part of the lesson was the least favorite, the voice over received some negative feedback, as well as the text size on some screens were too small to read. Although the researcher used the same narrator to keep the voice over consistent, the volume still fluctuated

due to some narrations being recorded at different times. These responses suggested that the narration should be recorded in the same session if possible or the researcher should create a nearly identical recording environment for the future design to avoid volume inconsistency. Regarding the issue of the text being too small, the researcher tried to put the same topic content into as few slides as possible, which caused some slides to have too much information and therefore, the text size was too small to read. This suggested that the researcher should find the most acceptable and readable text size and use it throughout the whole video project.

One participant commented that the likert-scale questions were his or her least favorite in this study. Unfortunately the reason was not stated so the researcher could not identify whether it was the wording of the questions or the style of the likert-scale questions that did not meet the participant's expectation.

Using more visual elements and less text based information were strongly suggested in the open-ended questions. Since the study was a video module, participants' expectation to see more visual elements and less text were understandable. Some information was difficult to present in a visual way. That being said, it is still possible to reduce the text based content and this should be taken into consideration in future designs for video projects.

Because this module was only teaching participants how to configure computers to conserve more energy in a Windows XP environment, some Macintosh users felt they were left out in this study. Although the decision was made based on the researcher's time limitation for this study, it indicated Macintosh users are also unfamiliar with setting their computers to be more energy efficient. This suggested the potential to expand the scope of the project into other systems such as Linux as well.

Implication of Research

Besides teaching computer users the skills and knowledge of energy conservation with their computers, this module intends to raise participants' awareness and change their attitude toward sustainability. New knowledge learned from this instructional video module will influence our community to build a more sustainable society. It is hoped that their interest in sustainability will lead to establishing policy that will help to protect our environment by making our manufacturers and consumers more responsible.

Although the use of subtitles was not the main study of this module, participants gave very positive feedback on the use of subtitles. This could be an area for further study to use subtitles in certain video projects. Most subtitle studies have focused on aiding learners who are deaf or hearing challenge. The researcher used subtitles to provide learners an option to suit their learning style. Researcher Whitney (2009) also refers to one of the most popular technology review websites, www.CNET.com, where it provides many online video reviews and all videos have a "cc" (closed caption) button that allows viewers to turn it on and off as needed. This is another example of the use of subtitles to serve a more general population.

Conclusions

The study results showed that using video to deliver the subject of sustainability was an effective and efficient method. Participants felt that the video pace and narration were appropriate and that the instruction was clear. Participants' responses support Yang, Huang, Tsai, Chung, & Wu (2009) who found that the use of multimedia has become an applicable resource in many curriculum settings. Participants gave overwhelmingly positive feedback towards the use of video. Participants felt the video was an effective way for learning new knowledge. This result supports Clark & Paivio (1991) who suggested that the human brain can learn better when watching imagery presentation rather than just listening to a verbal presentation.

Based on a subject matter expert's feedback, the video was modified prior to the small group testing. These modifications included adding a module overview in the beginning of the video, defining the terms "green" and "sustainability", and replacing some technology jargon with more common language. As a result of these modifications, the feedback received from the subject matter expert was not repeated from the small group.

To conclude, the use of video in an instructional design module can enhance the learning experience in both cognitive and affective domains for college students. The pre- and post-test results showed a significant improvement from before to after the module. The attitudinal survey also suggested that the participants were willing to take a step in becoming more sustainable in computer purchasing in the future. Most importantly, participants felt the use of video helped them to engage in the subject and created a positive learning experience.

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